

*Advancements in TEL-8 Teaching and Communication  
Via Web-based Technology*

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## **EXECUTIVE SUMMARY**

The principal investigators addressed many aspects of distance learning in a recently taught TEL8 course on bridge engineering. Their efforts are outlined in this report with respect to this course. The fruit of their effort is a better and more technologically advanced method of coupling TEL8 courses with the use of world-web technology. Instructor evaluations indicate that the online forum was particularly effective and should be used in the future. The development of on-line courses in the manner described requires a significant effort — much more than a traditional course. Appropriate compensation, teaching schedules, and recognition should be considered in the long term for the TEL8 system to remain a viable education media for college classes. Otherwise, it will be difficult to find instructors willing to dedicate the time necessary to make online courses the best that they can be.

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## **INTRODUCTION**

This report presents results and issues associated with teaching graduate level courses on the TEL8 system. The TEL8 system supports research involving communication using two-way interactive audio and video among 10 sites in the six states of FHWA Region 8. The specifics about one course presented from the University of Wyoming in the Spring 1997 semester are reported. Seven sites received the course titled “Bridge Engineering — an LRFD Approach,” using the MPC satellite network. It was attended by 55 graduate students and practitioners at CSU(9), USU(9), NDSU(2), UW(10), NDDOT(6), WYDOT(1), and MTDOT(18). The mix of practitioners and students was nearly even. A course description is attached for more information.

## **INNOVATION**

To teach a distance-learning course at the advanced level, significant preparation involving issues in instructional design, presentation, communication, and software is required. For this course, the instructor implemented and employed new technologies in the area of presentation and communication. Presentation materials were distributed weekly prior to class so each student had all handout materials during class. The students were then able to make notes, computations, etc., on the prepared materials. The class involved advanced concepts in analysis, statistics, and design. The theoretical and background portion of the lecture was presented with use of Microsoft PowerPoint slides. Forty to 80 slides per lecture were typical for this course, which was offered once a week in a three-hour time block. Duplicated slides often were necessary to illustrate points in a dynamic fashion. Software also was demonstrated online with the student viewing output results on hardcopy handouts. Advanced software, such as finite element analysis programs, was used to graphically illustrate

structural behavior that often is difficult to describe in the nongraphical manner. Animation also was helpful here. Examples were illustrated with hand computations via the overhead imager. Again, the students had all materials apriori.

Remote and multifaced communications are critical in designing and conducting distance learning courses. Students were widely dispersed in both distance, educational background, and practical experience. The diversity was helpful and problematic. The diversity supported good interaction and commentary on professional practice but tailoring lecture material suitable for students and practitioner was challenging. To foster good off-line communication and make personal interaction with the students possible and beneficial for all, the instructor developed several web pages specifically for this course. The web-page development was facilititate by the computing staff at UW.

The web page contained the following components:

- Introduction
- Site purpose
- Instructor information
- Syllabus
- Presentations
- Software descriptions
- Communications issues
- Homework solutions
- Old tests
- Bulletin board
- Discussion forum

- Anonymous mail
- Student database
- Web feedback
- Posting and download area
- Other bridge-related web sites

All pages proved to be useful but some were *critical* to the success of the course. Only the later pages are described here, however, for more detail please see the following web pages:

<http://wwweng.uwyo.edu/classes/ce5270/> (also please see the attached appendix).

## **KEY WEB PAGES**

### **Homework Solutions**

The homework solutions were posted soon after the homework due date. The students were encouraged to submit copies of their solutions and to make copies for their records of the instructor's homework solutions. All students could download the posted homework from the web pages. These pages were designed for printing. This approach fostered good turnaround and helped the students' learning. The assignments for this class were lengthy and detailed. At best, the turnaround for grading a class of this size was two weeks.

### **Bulletin Board**

Messages from the instructor were posted directly to a course bulletin board. By mid semester 25 messages had been posted. This helped to foster communication between classes, assignment

updates, notification of new software, etc. Assignments also were posted. This bulletin board was a valuable interactive device and is highly recommended for distance learning classes.

### **Discussion Forum**

The discussion forum was the most useful tool in the website and was developed specifically for this course. This form provided the student with an opportunity to post questions and anyone in the class had an opportunity to respond. Typically, the instructor answered most of the questions and the student or practitioner often had other responses. The discussion form designed for the class was a simple outline format.

A typical example follows:

*Student #1: This is a two-part question so I hope you give me credit for two questions. In Homework #3 you said the btbeam output gives critical truck position. Which axle is this for? I assumed it was the front but sometimes it didn't line up for max/min on the influence diagram. The second part asked if the output has forward/backward position. Which direction is forward?*

*Instructor: There may be a modest error in the report, but I'm not sure where at this point. The position for the computation should be fine, it just may be reported incorrectly in a few cases. The truck train is for the front axle on the front truck.*

*Student #2: Is the front axle the 145 KN axle if the truck is moving backwards?*

*Instructor: yes*

There were about 200 postings in the forum for the class. The forum takes a lot of instructor time and is the functional equivalent of office hours with the advantage that all students benefit from the query and response. This is critical in distance learning. Enhancing this part of the web page and tailoring it for specific applications is an option that other distance learning instructors should consider. However, the web page is readily adapted for use by others in its present form.

### **Anonymous Mail**

Anonymous mail was for students to post suggestions to the instructor without a posting address or name. The upside was that evaluations by students could be made at any time and the instructor was able to take advantage of their comments in a timely fashion. The downside was that specific issues could not be addressed with the individual because all record of the mailer address is stripped.

### **Posting and Download Area**

Computer software was distributed to the students via the download area. This greatly simplified distribution to the remote sites and to all students at a particular site.

### **Other Web-Based Sites**

Here FHWA, TRB, NAS, etc. pages were linked. The web page approach developed for the class essentially is a linking of the class page to a set of other action pages. The web page took a tremendous effort to develop and maintain with current information. However, given the number of sites and students this approach worked effectively. The web page can readily be used by other MPC instructors with minor modifications. The page can be further improved as time and funding permit. The value of off-line interaction using the web should be integrated into distance learning courses.

## GENERAL CONSIDERATIONS

The motto of the Boy Scouts is alive and well for distance learning — **BE PREPARED**. This report has highlighted tools helpful in that regard. Developing instruction and materials — logistics associated with these materials and contingency planning for system partial failure and for students that are unable to attend class — must be considered in advance. Considering the mixture of the class participants and backgrounds is equally important. Assessing this early was helpful in fine-tuning course materials and presentations. Integrating the remote sites and the on-site students must be constantly considered.

Being prepared takes time. For the “Highway Bridge Engineering — an LFRD Approach,” approximately 40 hours per week were required. It should be noted that the instructor is a recognized expert in the area of bridges, published a 1997 text book on the subject, specializes in software development and shares development of several programs that are appropriate for class. In short, teaching distance learning classes requires an extraordinary amount of work. Due to this critical characteristic of teaching distance learning classes, the appropriate compensation, teaching schedules, and recognition must be considered in the long term in order to keep the TEL8 system viable. Otherwise, it will be difficult to find instructors willing to dedicate the time necessary to make online courses the best that they can be. It is hopeful that the process and tools associated with the bridge engineering course will be used by other MPC instructors to make the process more efficient. Graduate education using the distance learning system of TEL8 worked effectively and can be further improved from both instructor and student perspectives by expanding the concepts and tools outlined.

## **APPENDIX**